

Applicant : Shuichi Kikuchi et al.
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Attorney's Docket No.: 10417-006001 / S21-
118827M/HW

In the claims:

Please amend the claims as follows:

1. (Currently Amended) A semiconductor device comprising a source region, a channel region, a drain region, a gate electrode disposed above the channel region, and a two-part drift region disposed adjacent to the channel region and extending to and below the drain region, wherein a first part of said drift region is formed shallowly at least below at least a substantial part of the gate electrode, and said first part has substantially uniform depth under said gate.;

wherein a second part of said drift region, having substantially uniform depth, but is formed more deeply than said first part and is located in a neighborhood of the drain region.

2. (Currently Amended) A semiconductor device comprising:
a first conductivity type well region formed in a first conductivity type semiconductor substrate;

a gate electrode formed on the substrate via a gate insulating film;

a first conductivity type body region formed to be adjacent to the gate electrode;

a second conductivity type source region and a channel region formed in the first conductivity type body region;

a second conductivity type drain region formed at a position remote from the first conductivity type body region; and

a two-part, second conductivity type drift region, with a first part having substantially uniform depth formed shallowly from the channel region to the drain region, at least below a substantial part of the gate electrode, and formed deeply a second part of said drift region in a neighborhood of the drain region, said second part having substantially uniform depth and being formed more deeply than said first part.

3. (Currently Amended) A semiconductor device according to claim 2, wherein the second conductivity type drift region is formed by implanting doped with

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at least two kinds of second conductivity type impurities which have different diffusions coefficients, and

at least one kind of first conductivity type impurity which has a diffusion coefficient substantially equal to or larger than the diffusion coefficient of at least one kind of second conductivity type impurity; and

~~[such that it is formed by diffusing the second conductivity type impurities into a deep region by using a difference in the diffusion coefficients and is formed shallowly in a neighborhood of the source region by canceling the second conductivity type impurities by the first conductivity type impurity]~~

the first conductivity type impurity cancels the second conductivity type impurities in the region below said shallowly formed first part.

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4. (Currently Amended) A semiconductor device according to claim 3, wherein the ~~second conductivity type drift region is formed by implanting an arsenic ion and a phosphorus ion as are the second conductivity type impurities into an overall surface of a region serving as the drift region and selectively implanting a boron ion is as the first conductivity type impurity only into a region in a neighborhood of the source region.~~

Claims 5-7 were previously cancelled.

8. (Currently Amended) A semiconductor device comprising a first MOS transistor having a source region, a channel region, a drain region, a gate electrode formed on the channel region, and a drift region formed between the channel region and the drain region, and a second MOS transistor having a source region, a channel region, a drain region, and a gate electrode formed on the channel region,

wherein the drift region of the first MOS transistor is formed shallowly at a uniform depth at least below a substantial part of the gate electrode but formed more deeply in a neighborhood of the drain region and

a source/drain region of the second MOS transistor consists of a low concentration source-drain region, a high concentration source-drain region, and a middle concentration

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source/drain region whose concentration is higher than that of the low concentration source/drain region but lower than that of the high concentration source/drain region.

9. (Currently Amended) A semiconductor device comprising a first MOS transistor and a second MOS transistor formed on a first conductivity type semiconductor substrate;

wherein the first MOS transistor includes,

a first conductivity type well region formed in the semiconductor substrate,

a first gate electrode formed on the first conductivity type well region via a first gate insulating film,

a first conductivity type body region formed to be adjacent to the first gate electrode,

a second conductivity type source region and a channel region formed in the first conductivity type body region,

a second conductivity type drain region formed at a position remote from the first conductivity type body region, and

a second conductivity type drift region formed shallowly from the channel region to the drain region, said second conductivity type drift region being formed shallowly at least below a substantial part of the gate electrode, and formed more deeply in a neighborhood of the drain region, and

wherein the second MOS transistor includes,

a second conductivity type well region formed in the semiconductor substrate,

a second gate electrode formed on the second conductivity type well region via a second gate insulating film, and

a source/drain region consisting of a low concentration source/drain region formed to be adjacent to the second gate electrode, a high concentration source/drain region, and a middle concentration source/drain region whose concentration is higher than that of the low concentration source/drain region but lower than that of the high concentration source/drain region.

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10. (Original) A semiconductor device according to claim 9, wherein the first MOS transistor consists of an N-channel LDMOS transistor, and the second MOS transistor consists of a P-channel high breakdown voltage MOS transistor.

Claims 11-16 were previously cancelled.

17. (Original) A semiconductor device according to claim 1, wherein the semiconductor device is arranged in plural via a element isolation film, and a channel stopper layer is formed under the element isolation film.

Claim 18 was previously cancelled.

19. (Currently Amended) A semiconductor device according to claim 2, wherein the second conductive type drift region is ~~formed to be~~ adjacent to the first conductive type body region.

20. (New) A semiconductor device in accordance with claim 1, wherein the entire first part of said drift region is located below said gate electrode.

21. (New) A semiconductor device in accordance with claim 2, wherein the entire first part of said drift region is located below said gate electrode.

22. (New) A semiconductor device in accordance with claim 1, wherein the dopant concentration of said first part is higher than that of said second part.

23. (New) A semiconductor device in accordance with claim 2, wherein the dopant concentration of said first part is higher than that of said second part.

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24. (New) A semiconductor device in accordance with claim 4, wherein the arsenic is implanted in the semiconductor substrate by an accelerating voltage of about 160 KeV at a dose of $3 \times 10^{12}/\text{cm}^2$.

25. (New) A semiconductor device in accordance with claim 8, wherein the low concentration source/drain region is formed by implanting boron in the semiconductor substrate at an accelerating voltage of about 80 KeV at a dose of $8 \times 10^{12}/\text{cm}^2$.

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26. (New) A semiconductor device in accordance with claim 8, wherein the middle concentration source/drain region is formed by implanting boron in the semiconductor substrate at an accelerating voltage of about 40 KeV at a dose of $5 \times 10^{13}/\text{cm}^2$.

27. (New) A semiconductor device in accordance with claim 2, wherein the gate electrode has a thickness of about 2500 Å.

28. (New) A semiconductor device in accordance with claim 1, wherein the source region is formed by implanting phosphorous in the semiconductor substrate at an accelerating voltage of about 40 KeV at a dose of $3.5 \times 10^{13}/\text{cm}^2$.

29. (New) A semiconductor device in accordance with claim 1, wherein the source region is formed by implanting phosphorous in the diffusion region at an accelerating voltage of about 40 KeV at a dose of $3.5 \times 10^{13}/\text{cm}^2$ and by implanting arsenic at an accelerating voltage of about 80 KeV at a dose of $5 \times 10^{15}/\text{cm}^2$, and the drain region is formed by implanting arsenic at an accelerating voltage of about 80 KeV at a dose of $5 \times 10^{15}/\text{cm}^2$.

30. (New) A semiconductor device in accordance with claim 1, wherein the drift region has an impurity concentration of about $1 \times 10^{17}/\text{cm}^3$.

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31. (New) A semiconductor device in accordance with claim 17, wherein the size of the element isolation film is about 5 μm to 8 μm and a distance from an end of the element isolation film to the channel stopper layer is about 2 μm to 3 μm . ✓

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32. (New) A semiconductor device in accordance with claim 17, wherein the channel stopper layer is formed in the semiconductor substrate by implanting boron at an accelerating voltage of about 60 KeV at a dose of $5 \times 10^{13}/\text{cm}^2$. OK